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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/933,304      | 08/20/2001  | Peter Lahner         | 6521/83562          | 5680             |

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EXAMINER

VINH, LAN

ART UNIT PAPER NUMBER

1765

DATE MAILED: 12/10/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

### Office Action Summary

**Application No.**

09/933,304

**Applicant(s)**

LAHNOR ET AL.

**Examiner**

Lan Vinh

**Art Unit**

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 04 November 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 2-8 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 2-8 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☒ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☒ Certified copies of the priority documents have been received in Application No. 09/933,304.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_ 6) ☐ Other:

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 11/4/2003 has been entered.

### ***Claim Rejections - 35 USC § 102***

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

3. Claims 2, 4, 5, 6, 8 are rejected under 35 U.S.C. 102(e) as being anticipated by Abe (US 6,455,430).

Abe discloses a method of embedding contact hole by damascene method and CMP (Chemical mechanical polishing). This method comprises the steps of:

forming a groove/via 109 in the dielectric layer 107 (fig. 1D),

forming a metal layer (titanium) 111/liner over the whole surface/area on the dielectric layer 107 and groove/contact via 109 (col 2, lines 64-65; fig. 1E ), depositing a

metalization layer 113 of copper over the whole surface/area on the dielectric layer 107 and in the groove 109), forming a carbon film 108 (claimed auxiliary layer) on the dielectric layer 107 between the liner 111 and the dielectric layer 107 surrounding the contact via 109 (col 2, lines 42-45, fig. 1E), performing a CMP process to remove the metal layer 113 on the layer 111/liner and cut/perforate the layer 108/auxiliary layer (col 3, lines 10-16, fig. 1F also shows the layer 111 is cut/perforated ), the polishing process stops on the dielectric layer as seen in fig. 2C. In one embodiment of Cain, fig. 4C shows the perforated layer 402/auxiliary layer with a portion of layer 402 is removed, fig. 4C also shows the liner layer, inside the connection 405, is lifted off from the dielectric layer 401.

Regarding claim 2, Abe discloses that the carbon layer 108/auxiliary layer having a thickness of 200 Angstroms (20 nm), which overlaps the claimed range of 20-100 nm.

The limitation of the auxiliary layer is composed of diamond-like carbon, as recited in claim 6, has been discussed above.

Regarding claim 4, Abe discloses that the carbon layer 108/auxiliary layer serves as a stopper in the polishing step (col 3, lines 25-28), which reads on detecting the auxiliary layer by an etching stop detection.

Regarding claim 5, Abe discloses the step of performing ultrasonic surface cleaning /wet chemical cleaning step after the etching step (col 4, lines 10-14)

***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Abe (US 6,455,430) in view of Li et al (US 6,331,479)

Abe's method has been described above in paragraph 3. Regarding claim 3, Abe discloses performing a plasma/dry etching step (col 4, lines 32-35). Unlike the instant claim invention as per claim 3, Abe does not disclose using the layer 108/auxiliary layer partly as a hard mask for the patterning preceding the dry etching.

However, Li discloses a method for forming copper damascene interconnect comprises the step of using the perforated layer 104, deposited between a liner 114 and dielectric layer 100, partly as a hard mask for the patterning preceding the dry etching (col 5, lines 36-67) which reads on using an auxiliary layer partly as a hard mask for the patterning preceding the dry etching.

One skilled in the art would have found it obvious to employ Abe's layer 108/auxiliary layer as a hard mask for the patterning preceding the dry etching as taught by Li because according to Li the presence of layer 104/hard mask layer protects the dielectric layer from damage due to plasma (col 6, lines 7-9 )

6. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Abe (US 6,455,430) in view of Schwalke et al (US 5,726,094)

Abe's method has been described above in paragraph 3. Unlike the instant claimed invention as per claim 7, Abe does not disclose using the carbon layer 108/ auxiliary layer in conjunction with a CARL resist as bottom resist

However, Schwalke discloses a process for producing a diffusion region adjacent to a recess in a substrate comprises the step of using a layer 6 deposited between a dielectric layer 43 and liner 12 in conjunction with a CARL resist layer 14 as bottom resist (col 4, lines 26-45; col 5, lines 34-41 and fig. 12 ) which reads on using an auxiliary layer in conjunction with a CARL resist as bottom resist

Hence, one skilled in the art would have found it obvious to modify Abe method by using the auxiliary layer in conjunction with a CARL resist as bottom resist as per Schwalke because according to Schwalke in order to structure the diffusion layer, a bottom resist layer is preferable applied to the diffusion layer (col 3, lines 10-18 )

### ***Response to Arguments***

7. Applicant's arguments with respect to claims 2-8 have been considered but are moot in view of the new ground(s) of rejection.

***Conclusion***

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is 703 305-6302. The examiner can normally be reached on M-F 8:30-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 703 305-2667. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872-9310 for regular communications and 703 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308-0661.



LV  
December 3, 2003